Paper No. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte FRANK L. SCHMIT,
LLOYD EWING
and
DAVID T. REDMON

Appeal No. 1998-0425
Application No. 08/272,527

ON BRIEF

Before STONER, Chief Administrative Patent Judge, FRANKFORT and NASE, Administrative Patent Judges.

NASE, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection (Paper No. 13, mailed October 30, 1996) of claims 2, 3 and 11 to 32, which are all of the claims pending in this application.

We REVERSE.

BACKGROUND

The appellants' invention relates to the treatment of liquid media containing organic and/or inorganic foulants (specification, p. 1). A copy of the claims under appeal is set forth in Appendix A of this decision.

The sole ground of rejection before us in this appeal is as follows:

> Claims 2, 3 and 11-32 are again rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 4,889,620[1] in view of claims 1-38 of U.S. Patent No. 5,328,601[2]. It would have been obvious to modify the claimed apparatus of U.S. Patent No. 4,889,620 to include the sealing means, retaining means, and/or measuring means recited in the claims of U.S. Patent No. 5,328,601. Further modifications such as the use of resin plenums or hundreds of diffusion elements would have been obvious to one of ordinary skill in the art. [Final rejection, p. 2].

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[1] Claims 1-20 of U.S. Patent No. 4,889,620 are set forth in Appendix B of this decision.

[2] Claims 1-38 of U.S. Patent No. 5,328,601 are set forth in Appendix C of this decision.

The argument set forth by the appellants on pages 4-7 of their brief (Paper No. 20, filed March 28, 1997) is as follows:

> Each of the two patents relied upon to support the rejection ("the cited patents") is a parent case of the present application. For verification of the parent status of these two patents, please see page 1 of the specification of this application and the preliminary amendment filed in this case on July 11, 1994 attached hereto as Appendix B.
>
> Obviousness-type double patenting is a judicially created doctrine that may, in certain instances, prevent the owner of a pending application from using that application as a vehicle to obtain claims which vary from the owner's prior patent claims only in ways that are obvious in view of the prior art. In re Braithwaite, 154 USPQ 29 (CCPA 1967).
>
> The claims of a parent patent can be used as a basis ("base patent") for a double patenting rejection, but these claims cannot be treated as "prior art." In re White and Langer, 160 USPQ 417, 418 (CCPA 1969); In re Sutherland, 146 USPQ 485, 491 (CCPA 1965) ("the words of such claims cannot be treated as "prior art"); In re Bartfeld, 17 USPQ2d 1885, 1888 (Fed. Cir. 1991) ("Double patenting depends entirely on what is claimed in an issued patent. Obviousness relates to what is disclosed in a prior art reference"). Thus, a rejection founded on a conclusion that claims in an application differ from claims of a base patent only in an obvious manner must be supported by citation of an additional reference that represents prior art relative to the application claims.
>
> Ex parte Oetiker, 23 USPQ2d 1651 (Bd. App. 1990) dealt with the types of evidence which must be supplied to support double patenting (obviousness) rejections. In Oetiker the Board noted that

> [2] The test for obviousness-type double patenting is ... whether the claimed invention in the subject application would have been obvious from the subject matter of the claims in the other case ... in light of the prior art. See In re Longi, 774 F.2d 1100, 225 USPQ 645 (Fed. Cir. 1985).
>
> In the present case, it is evident that the claims in appellant's copending application differ from claims 1 through 7 and 14 through 20 in the subject application by reciting, inter alia, the hook means for closing the clamping band. The Examiner has cited no prior art whatever for showing that this difference amounts to an obvious modification of the invention defined in claims 1 through 7 and 14 through 20. For these reasons, the double patenting rejection ... cannot stand.

Oetiker at 1654 (emphasis added). Oetiker and Longi both appear to stand for the proposition that prior art must be cited to support an obviousness-type double patenting rejection. Absent citation of prior art in addition to the base patent, there is no factual basis for the rejection.

Although in theory either of the cited patents might have been properly used as a base patent supporting an obvious-type double patenting rejection, since each of the two patents relied upon to support the rejection is a parent case of the present application, neither of them is available as "prior art" under 35 U.S.C. § 103 in the present instance.

Longi indicates why a parent patent may not serve as the prior art to be used in conjunction with a base patent to support an obviousness-type double-patenting rejection.

> The public should . . . be able to act on the assumption that upon the expiration of the patent it

> will be free to use not only the invention claimed in the patent but also modifications or variants which would have been obvious to those of ordinary skill in the art at the time the invention was made.

Id. at 648.

> A parent patent, from which a rejected application derives internal priority under 35 U.S.C. § 120, does not represent prior art. Prior art, according to 35 U.S.C. § 102, must have been available as a reference at the time the invention was made. In re Gieger and Wilfert, 165 USPQ 572, 574-575 (CCPA 1970). Thus, the claims of the '601 are not "prior art" for the purpose of supporting an obviousness-type double patenting rejection based upon the claims of the '620 patent. The '601 patent was filed on October 12, 1989 as a continuation of the '620 patent (which issued on December 26, 1989). The '601 patent issued on July 12, 1994 having claims based upon the same disclosure as that of the claims of the '620 base patent. Clearly, the claims of the '601 patent do not represent evidence of what was known to others "at the time the invention was made", as required by Longi.

The examiner's response to the appellants' argument set forth by the examiner on pages 5-6 of the answer (Paper No. 21, mailed July 9, 1997) is as follows:

> The case law citations furnished by appellants have been carefully considered by the examiner, but none of them seem to duplicate the situation in the instant application. Since appellants concede that "...either of the cited patents might have been properly used as a base patent supporting an obviousness-type double patenting rejection...", why can they not be used in additive combination to support an obviousness-type double patent rejection? The disclosure and claims of the instant

> application are seen to be a combination of the claims of appellants' two prior patents. It would not seem to be in the best interests of the public to allow appellants an extension of the monopoly provided by the two prior patents merely by combining the claims of the two in a new application which combines the patentable features of the existing patent claims.

In response to the answer, the appellants submitted additional argument on pages 1-4 of their reply brief (Paper No. 22, filed September 9, 1997) as follows:

> The Answer also asserts that
>
> > "[s]ince applicants have conceded that each of the two patents is available as a 'base patent' in an obviousness-type double patenting rejection, their use in additive combination in such a rejection is seen to be proper (emphasis added)." See page 5 of the Answer.
>
> However, as the Answer itself shows in part in the last line of the same page, and as page 6 of Applicants' Appeal Brief shows more completely, this assertion proceeds from a faulty premise. What Applicants have agreed is that
>
> > ". . . in theory either of the cited patents might have been properly used as a base patent supporting an obvious-type double patenting rejection . . . (emphasis added)"
>
> The word "either," in this context, referred to use of one or the other of the parent patents, but not to use of both of them together. Applicants have never conceded:

(a) that either of these parent patents constituted prior art,
(b) that use of both parent patents in combination was proper,
(c) that the combination of these patents satisfied the requirement, set forth in prior decisions of this Honorable Board, for citation of prior art to support an obviousness double patenting rejection, or
(d) that the parent patents, singly or in combination, demonstrated the obviousness of the claimed subject matter; no proper double-patenting obviousness rejection having been made, it was not incumbent on Applicants to provide obviousness arguments.

Proceeding from the above-described faulty premise, the Answer posed the following question concerning the parent patents:

> "[W]hy can they not be used in additive combination to support an obviousness-type double patent rejection?" See page 6 of the Examiner's Answer.

Use of such combinations in lieu of prior art violates the requirements of such precedents as Oetiker and Longi, cited in Applicants' Brief, which have held that prior art must be provided to support double patenting obviousness rejections.

The Examiner also argues that

> "[t]he disclosure and claims of the instant application are seen to be a combination of the claims of appellants' two prior patents. It would not seem to be in the best interests of the public to allow appellants an extension of the monopoly provided by the two prior patents merely by combining the claims of the two in a new application which combines the patentable features of the

existing patent claims." See page 6 of the Examiner's Answer.

The "extension of the monopoly argument is misplaced." What monopoly is being extended?

The Answer has not established that the claims in issue are the same invention as the subject matter of the claims of either of the prior patents. No "same invention" double patenting rejection has been maintained. Use of the double patenting rejection tacitly admits that there are differences between the claims at issue and those of either one of the parent patents. Nor has the Answer established that prior art demonstrates the claims in issue to be an obvious extension of what is claimed in either one of the prior patents. Thus, the patent protection that would be afforded by grant of the claims in issue, and that would continue after the parent patents expire, is not the same invention as, or an obvious extension of the protection afforded by, either parent patent. If the present claims are issued, there will be no extension of any monopoly previously granted to applicant.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims, and to the respective positions set forth by the appellants and the examiner. Upon evaluation of all the evidence before us, it is our conclusion that the decision of the examiner to reject claims 2, 3 and 11 to 32 under the judicially created doctrine of obviousness-type double

patenting must be reversed. Our reasoning for this determination follows.

Double patenting is a legal doctrine that forbids an inventor from obtaining a second valid patent for either the same invention or an obvious modification of the same invention claimed in that inventor's first patent. See In re Longi, 759 F.2d 887, 892, 225 USPQ 645, 648 (Fed. Cir. 1985). The basic concept of double patenting is that the same invention cannot be patented more than once since to do so would result in a second patent that would expire some time after the first patent expired and extend the protection timewise. General Foods Corp. v. Studiengesellschaft Kohle mbH, 972 F.2d 1272, 1279-80, 23 USPQ2d 1839, 1845 (Fed. Cir. 1992); In re Kaplan, 789 F.2d 1574, 1579-80, 229 USPQ 678, 683 (Fed. Cir. 1986).

35 U.S.C. § 101 states "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor..." (Emphasis added). The

prohibition of double patenting of the same invention is based on 35 U.S.C. § 101. In re Goodman, 11 F.3d 1046, 1052, 29 USPQ2d 2010, 2015 (Fed. Cir. 1993); Longi, 759 F.2d at 892, 225 USPQ at 648. By "same invention," the court means "identical subject matter." Longi, 759 F.2d at 892, 225 USPQ at 648; In re Vogel, 422 F.2d 438, 441, 164 USPQ 619, 621 (CCPA 1970). A good test, and probably the only objective test, for "same invention," is whether one of the claims would be literally infringed without literally infringing the other. If it could be, the claims do not define identically the same invention. Vogel, 422 F.2d at 441, 164 USPQ at 621-22 (halogen is not the "same" as chlorine; meat is not the "same" as pork). All types of double patenting which are not "same invention" double patenting have come to be referred to as "obviousness-type" double patenting. See In re Van Ornum, 686 F.2d 937, 942-43, 214 USPQ 761, 766 (CCPA 1982), which states in discussing cases leading to Vogel's restatement of the law of double patenting,[3,4]

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[3] Vogel, 422 F.2d at 441-42, 164 USPQ at 621-22.

[4] Judge Rich in Kaplan, 789 F.2d at 1579, 229 USPQ at 682,
(continued...)

> numerous cases were considered in which application claims were directed to mere obvious modifications of, or improvements on, inventions defined in the claims of patents already issued to the same inventors, or to common assignees, and it had been decided that they might be allowed to go to patent if the applicants filed terminal disclaimers. We classified these as "obviousness type double patenting." This latter classification has, in the course of time, come, somewhat loosely, to indicate any "double patenting" situation other than one of the "same invention" type.

See also General Foods, 972 F.2d at 1279-80, 23 USPQ2d at 1844-45.

"Obviousness-type" double patenting extends the fundamental legal doctrine to preclude "obvious variants" of what has already been patented. See In re Berg, 140 F.3d 1428, 1432, 46 USPQ2d 1226, 1229 (Fed. Cir. 1998); Goodman, 11 F.3d at 1052, 29 USPQ2d at 2015 and General Foods, 972 F.2d at 1280, 23 USPQ2d at 1845. "Obviousness-type" double patenting precludes issuance where there is no "patentable difference" or no "patentable distinction" between the two claims. Goodman, 11 F.3d at 1052, 29 USPQ2d at 2015; General Foods,

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[4](...continued)
stated that the restatement of the law of double patenting set forth in Vogel "serves as a good starting place" for deciding the double patenting issue raised in that appeal.

972 F.2d at 1278-79, 23 USPQ2d at 1844. This allows the public to practice obvious variations of the first patented invention after the first patent expires. See Longi, 759 F.2d at 892-93, 225 USPQ at 648. The courts adopted the doctrine out of necessity where claims in two applications by the same inventor were so much alike that to allow the latter would effectively extend the life of the first patent. See Gerber Garment Technology, Inc. v. Lectra Sys., 916 F.2d 683, 686 16 USPQ2d 1436, 1439 (Fed. Cir. 1990); In re Thorington, 418 F.2d 528, 534, 163 USPQ 644, 648 (CCPA 1969), cert. denied, 397 U.S. 1038, 165 USPQ 290 (1970).

In summary, "obviousness-type" double patenting is a judge-made doctrine that prevents an unjustified extension of the patent right beyond the statutory time limit. It requires rejection of an application claim when the claimed subject matter is **not patentably distinct** from the subject matter claimed in a commonly owned patent when the issuance of a second patent would provide an unjustified extension of the term of the right to exclude granted by a patent. In order to overcome an "obviousness-type" double patenting rejection, an

applicant may file a "terminal disclaimer," foregoing that portion of the term of the second patent that extends beyond the term of the first. Berg, 140 F.3d at 1431-32, 46 USPQ2d at 1229.

Thus, if a claim sought in the application is not identical to yet **not patentably distinct** from a claim in an inventor's earlier patent, then the claim must be rejected under "obviousness-type" double patenting rejection. See Berg, 140 F.3d at 1431, 46 USPQ2d at 1229; In re Braat, 937 F.2d 589, 592, 19 USPQ2d 1289, 1291-92 (Fed. Cir. 1991); Goodman, 11 F.3d at 1052, 29 USPQ2d at 2015; Vogel, 422 F.2d at 441, 164 USPQ at 622. In determining whether a claim sought in the application is **patentably distinct** from the claims in an inventor's earlier patent a variety of tests have been utilized. In Berg, 140 F.3d at 1433-34, 46 USPQ2d at 1230-31 and In re Emert, 124 F.3d 1458, 1461-62, 44 USPQ2d 1149, 1152 (Fed. Cir. 1997), a "one-way" test was applied. Under this "one-way" test, the examiner asks whether the application claims are obvious over the patent claims. In

Goodman, 11 F.3d at 1052-53, 29 USPQ2d at 2015-16 and Van Ornum, 686 F.2d at 942-43, 214 USPQ at 766-67, a test similar to the "one-way" test was applied. Under this test, the examiner asks whether the application claims are generic to any species set forth in the patent claims. In In re Dembiczak, 175 F.3d 994, 1002, 50 USPQ2d 1614, 1619-20 (Fed. Cir. 1999) and Braat, 937 F.2d at 593-94, 19 USPQ2d at 1292-93, a "two-way" test was applied. Under this "two-way" test, the examiner asks whether the application claims are obvious over the patent claims and also asks whether the patent claims are obvious over the application claims.

From our review of the above-cited case law and other cases involving an "obviousness-type" double patenting rejection we have been unable to discover any support for the type of rejection before us in this appeal (i.e., an "obviousness-type" double patenting rejection wherein two claims from separate patents, neither of which are prior art to the appellants, are combined together). In fact, the case law clearly demonstrates that the examiner must establish that each application claim being rejected under "obviousness-type"

double patenting is not patentably distinct from a claim in an inventor's earlier patent. Since in making the determination that it would have been obvious to modify the claimed apparatus of U.S. Patent No. 4,889,620 to include the sealing means, retaining means, and/or measuring means recited in the claims of U.S. Patent No. 5,328,601 the examiner relied on an inappropriate mode of analysis in attempting to establish "obviousness-type" double patenting, we will not sustain the examiner's specific rejection of claims 2, 3 and 11 to 32.[5]

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[5] We note that the claims under appeal recite limitations (e.g., acid resistant supply piping having a synthetic resin inner surface (claim 2); synthetic thermoplastic or thermoset resin plenums (claims 3, 11 and 23); details of the diffusion plates; etc.) not found in any claim in U.S. Patent Nos. 4,889,620 and 5,328,601. The examiner's mere assertion that these differences would have been obvious to one of ordinary skill in the art is not sufficient to establish that such differences would have been obvious since the examiner has not provided any evidence to support that assertion. Evidence of a suggestion, teaching, or motivation to modify a reference may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved, see Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed. Cir. 1996), Para-Ordinance Mfg. v. SGS Imports Intern., Inc., 73 F.3d 1085, 1088, 37 USPQ2d 1237, 1240 (Fed. Cir. 1995), although "the suggestion more often comes from the teachings of the pertinent references," In re Rouffet, 149 F.3d 1350, 1355, 47 USPQ2d 1453, 1456 (Fed. Cir. 1998). The range of sources available, however, does not diminish the requirement for actual evidence. That is, the showing must be clear and

(continued...)

In addition, the examiner has failed to establish that the claims under appeal are not patentably distinct from any one of claims 1-20 of U.S. Patent No. 4,889,620 or any one of claims 1-38 of U.S. Patent No. 5,328,601. Likewise, the examiner has failed to establish that the claims under appeal are obvious from or generic to any one of claims 1-20 of U.S. Patent No. 4,889,620 or any one of claims 1-38 of U.S. Patent No. 5,328,601. Accordingly, the decision of the examiner to reject claims 2, 3 and 11 to 32 under the judicially created doctrine of "obviousness-type" double patenting is reversed.

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[5](...continued)
particular. See, e.g., C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998). A broad conclusory statement regarding the obviousness of modifying a reference, standing alone, is not "evidence." E.g., McElmurry v. Arkansas Power & Light Co., 995 F.2d 1576, 1578, 27 USPQ2d 1129, 1131 (Fed. Cir. 1993); In re Sichert, 566 F.2d 1154, 1164, 196 USPQ 209, 217 (CCPA 1977). See also In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999).

CONCLUSION

To summarize, the decision of the examiner to reject claims 2, 3 and 11 to 32 under the judicially created doctrine of obviousness-type double patenting is reversed.

REVERSED

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BRUCE H. STONER, JR. Chief Administrative Patent Judge	)	
CHARLES E. FRANKFORT Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
JEFFREY V. NASE Administrative Patent Judge	)	

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APPENDIX A

2. Wastewater treatment apparatus comprising:
a tank, having a bottom surface, equipped for biological treatment of said wastewater;
a gas distribution network in said tank including generally horizontal acid resistant supply piping in said tank positioned above said bottom surface and having synthetic resin inner surfaces;
a compressor or blower for introducing air into said network;
a high pressure storage vessel for introducing HCl gas into said network, intermittently, alone or in admixture with said air;
a plurality of flow regulating orifices of fixed or auto adjustable size distributed about a submerged portion of the network for receiving the aforementioned air and HCL gas and for discharging them at predetermined flow rates into a plurality of plenums downstream of the flow regulating orifices;
a plurality of multi-pore ceramic flat plate diffusion elements, free of fastener through holes, in communication with said plenums for receiving said gases, said diffusion elements being members each comprising a multiplicity of closely spaced fine pores of about 120 to about 300 microns in diameter defining paths for discharge of said gases and which exhibit an increase in dynamic wet pressure, as compared to a base condition of said pressure, as a result of deposition of foulants, each of said diffusion elements having, and being in communication, through its plenum, with its own individual~flow regulating orifice;
at least about 90% of said diffusion elements being capable, when new, of delivering a flux which is within about +/- 15% of the average flux of all such elements, when operated at 2 inches of water gauge in a dry unsubmerged condition;

said diffusion elements having central and boundary portions
with enhanced volumetric compression ratios, said central portions having volumetric compression ratios of about 2 to about 20% relative to the portions of the elements surrounded thereby and said boundary portions having outwardly and downwardly inclined upper surfaces at an angle of depression of about 35 to about 60 degrees relative to the horizontal and having volumetric compression ratios of about 10 to about 35% relative to the portions of the elements surrounded by said boundary portion;

said diffusion elements each having a bubble release pressure of about 5 to about 10 inches of water gauge and a coefficient of variation not greater than about 0.25, said coefficient of variation being based on the values of bubble release pressure measurements at, at least, about 5 equally spaced points along each of two mutually perpendicular reference lines extending across said surface and through the center thereof;

said plenums, mounted on said piping at elevated positions relative to said bottom surface, each comprising gastight enclosures that enclose the lower surface of said diffusion elements and include upstanding walls facing and adjacent to the sides of the diffusion elements, the peripheries of said elements having annular steps formed about the upper portions of the peripheral surfaces of the diffusion elements for positioning sealing O-rings on said annular step for sealing contact with the respective plenums and elements, said sealing O-rings being comprised of resilient, elastomeric material; and

retaining rings indirectly in contact with said elements at their respective peripheries for securing said elements around their entire peripheries to their respective plenums, said retaining rings including upright, cylindrical walls and flanges which at least partly overlie the sealing O-rings, said flanges restraining upward movement of said sealing O-rings and elements, whereby said upward force on said elements acts upwardly on said sealing O-rings and against said sealing O-rings, for increasing the sealing integrity of said sealing O-rings and preventing escape of gas from the plenums at the sides of the elements.

3. Liquid treatment apparatus comprising:
a gas distribution network in a tank;
means for introducing treating gas into said network;
a source of cleaning agent;
means including valve means for intermittently introducing into said network said cleaning agent alone or in admixture with the treating gas;
a plurality of synthetic thermoplastic or thermoset resin plenums;
a plurality of flow regulating means distributed about a submerged portion of the network for receiving the aforementioned treating gas and cleaning agent and for discharging them into a plurality of plenums downstream of the flow regulating means, said flow regulating means tending to promote flow into said plenums at similar rates;
a plurality comprising hundreds of diffusion elements sealingly engaged and in communication with said plenums for receiving said treating gas and cleaning agent, said elements having air diffusion pores extending therethrough, but being free of through-holes other than air diffusion pores, said pores defining paths for discharge of said treating gas and cleaning agent and which exhibit an increase in dynamic wet pressure and/or bubble release pressure as a result of deposition of foulants, each of said diffusion elements being in communication with its own individual flow regulating means through its own individual plenum downstream of the flow regulating means for tending to promote gas flow through said diffusion elements at similar rates;
retaining means engaging said diffusion elements about their peripheries for securing said elements to said plenums;
sealing means adjacent the peripheries of the diffusion elements for preventing leakage of air from said plenums past the peripheries of said elements; and
measuring means for monitoring the operation of said liquid treatment apparatus by measuring changes in operating parameters of the apparatus that indicate dynamic wet pressure changes across the diffusion elements with sufficient precision for initiating the flow of cleaning agent with sufficient frequency for maintaining the dynamic wet pressure across the diffusion elements in a range not to exceed about

25 inches of water gauge above a base condition of said elements.

11. Liquid treatment apparatus comprising:
a gas distribution network in a water impound;
means for introducing treating gas into said network;
a source of cleaning agent;
means including valve means for intermittently introducing into said network said cleaning agent alone or in admixture with the treating gas;
a plurality of synthetic thermoplastic or thermoset resin plenums;
a plurality of a least ten diffusion elements sealingly engaged and in communication with said plenums for receiving said treating gas and cleaning agent, said elements having air diffusion pores extending therethrough, but being free of through-holes other than air diffusion pores, said pores defining paths for discharge of said treating gas and cleaning agent and which exhibit an increase in dynamic wet pressure and/or bubble release pressure as a result of deposition of foulants;
retaining means engaging said diffusion elements about their peripheries for securing said elements to said plenums;
sealing means adjacent the peripheries of the diffusion elements for preventing leakage of air from said plenums past the peripheries of said elements; and
measuring means for monitoring the operation of said liquid treatment apparatus by measuring changes in operating parameters of the apparatus that indicate dynamic wet pressure changes across the diffusion elements with sufficient precision for initiating the flow of cleaning agent with sufficient frequency for maintaining the dynamic wet pressure across the diffusion elements in a range not to exceed about 25 inches of water gauge above a base condition of said elements.

12. The apparatus according to claim 2 further comprising measuring means for monitoring operation of said waste treatment apparatus by measuring changes in operating parameters of the apparatus that indicate dynamic wet pressure changes across the diffusion elements with sufficient precision for initiating the flow of cleaning agent with sufficient frequency for maintaining the dynamic wet pressure across the diffusion elements in a range not to exceed about 25 inches of water gauge above a base condition of said elements.

13. The apparatus according to claim 3, 11 or 12 wherein said measuring means comprises means for measuring pressure across or flow of gas through one or more diffusion elements.

14. The apparatus according to claim 3, 11 or 12 wherein said measuring means comprises means for measuring the pressure across and flow of gas through one or more diffusion elements.

15. The apparatus according to claim 3, 11 or 12 wherein said measuring means comprises means for measuring said changes with sufficient precision to maintain the dynamic wet pressure across the diffusion elements in a range not to exceed about 15 inches of water gauge above said base condition.

16. The apparatus according to claim 3 or 12 wherein said measuring means comprises means for measuring the hydrostatic pressure of said liquid at about the elevation of the diffusion elements, means for measuring gas pressure within a plenum downstream of a flow-regulating means, and means for measuring the gas pressure within a header supplying gas to said flow regulating means.

17. The apparatus according to claim 3, 11 or 12 wherein said measuring means includes means for measuring the dynamic wet pressure across one or more of said diffusion elements.

18. The apparatus according to claim 3 wherein said diffusion elements are divided into at least two groups, said

measuring means includes flow measuring means for measuring the respective flow or flows of gas through at least one selected group among said at least two groups, and said apparatus includes controlling means for controlling flow of cleaning agent to one or more of said selected groups.

19. The apparatus according to claim 11 wherein said diffusion elements are divided into at least two groups, said measuring means includes flow measuring means for measuring the respective flow or flows of gas through at least one selected group among said at least two groups, and said apparatus includes controlling means for controlling flow of cleaning agent to one or more of said selected groups.

20. The apparatus according to claim 18 or 19 wherein said controlling means is capable of passing cleaning agent to one or more of said selected groups with a flow which differs from the flow of cleaning agent, if any, to one or more other groups among said at least two groups.

21. The apparatus according to claim 18 or 19 wherein said measuring means includes pressure measuring means for measuring the respective pressure or pressures of gas flowing through at least one selected group among said at least two groups, and said apparatus includes controlling means for controlling the flow of cleaning agent to one or more of said selected groups in response to measurements made by said measuring means.

22. The apparatus according to claim 3 or 11 wherein said sealing means, retaining means and plenums jointly restrain vertical movement of said diffusion elements.

23. Liquid treatment apparatus comprising:
a gas distribution network in a tank;
a source of treating gas;
a source of cleaning agent;
a flow control device located in a flow path between said source of cleaning gas and said gas distribution network;
a plurality of synthetic thermoplastic or thermoset resin plenums;

a plurality of flow regulators distributed about a submerged portion of the network capable of receiving the aforementioned treating gas and cleaning agent and discharging them into said plurality of plenums downstream of the flow regulators, said flow regulators tending to promote flow into said plenums at similar rates;

a plurality comprising hundreds of multi-pore area release diffusion elements sealingly engaged and in communication with said plenums for receiving said treating gas and cleaning agent, said elements having air diffusion pores extending therethrough, but being free of through-holes other than air diffusion pores, said pores defining paths for discharge of said treating gas and cleaning agent, said elements exhibiting an increase in dynamic wet pressure and/or bubble release pressure as a result of deposition of foulants, each of said diffusion elements being in communication with its own individual flow regulator device through its own individual plenum downstream of the flow regulator for tending to promote gas flow through said diffusion elements at similar rates;

retaining means engaging said diffusion elements about their peripheries for securing said elements to said plenums;

sealing means adjacent the peripheries of the diffusion elements for preventing leakage of air from said plenums past the peripheries of said elements; and

at least one measuring device capable of measuring changes in operating parameters of the apparatus indicating dynamic wet pressure changes across the diffusion elements with sufficient precision for initiating the flow of cleaning agent with sufficient frequency for maintaining the dynamic wet pressure across the diffusion elements in a range not to exceed about 25 inches of water gauge above a base condition of said elements.

24. The apparatus according to claim 23 wherein said at least one measuring device comprises pressure or flow measuring devices capable of measuring pressure across or flow of gas through one or more diffusion elements.

25. The apparatus according to claim 23 wherein said at least one measuring device comprises pressure and flow measuring devices capable of measuring the pressure across and flow of gas through one or more diffusion elements.

26. The apparatus according to claim 23 wherein said at least one measuring device comprises at least one device capable of measuring said changes with sufficient precision to maintain the dynamic wet pressure across the diffusion elements in a range not to exceed about 15 inches of water gauge above said base condition.

27. The apparatus according to claim 23 wherein said at least one measuring device comprises at least one device capable of measuring the hydrostatic pressure of said liquid at about the elevation of the diffusion elements, at least one device capable of measuring gas pressure within a plenum downstream of a flow regulator, and at least one device capable of measuring the gas pressure within a header supplying gas to said flow regulator.

28. The apparatus according to claim 23 wherein said at least one measuring device includes at least one dynamic wet pressure measuring device capable of measuring the dynamic wet pressure across one or more of said diffusion elements.

29. The apparatus according to claim 23 wherein said diffusion elements are divided into at least two groups, said at least one measuring device includes at least one flow measuring device capable of measuring the respective flow or flows of gas through at least one selected group among said at least two groups, and said apparatus includes at least one controlling device capable of controlling flow of cleaning agent to one or more of said selected groups.

30. The apparatus according to claim 29 wherein said at least one controlling device is capable of passing cleaning agent to one or more of said selected groups with a flow which differs from the flow of cleaning agent, if any, to one or more other groups among said at least two groups.

31. The apparatus according to claim 29 or 30 wherein said at least one measuring device includes at least one pressure measuring device capable of measuring the respective pressure or pressures of gas flowing through at least one selected group among said at least two groups, and said at least one controlling device is capable of controlling flow of cleaning agent to one or more of said selected groups in response to measurements made by said measuring device.

32. The apparatus according to claim 23 wherein said sealing means, retaining means and plenums jointly restrain vertical movement of said diffusion elements.

APPENDIX B

1. Liquid treatment apparatus comprising:
a gas distribution network in a tank;
means for introducing treating gas into said network;
a source of cleaning gas;
means including valve means for intermittently introducing into said network said cleaning gas alone or in admixture with the treating gas;
a plurality of flow regulating means distributed about a submerged portion of the network for receiving the aforementioned gases and for discharging them into a plurality of plenums downstream of the flow regulating means, said flow regulating means tending to promote gas flow into said plenums at similar rates; and
a plurality of at least ten multi-pore area release diffusion elements sealingly engaged and in communication with said plenums for receiving said gases, and diffusion elements being members which comprise a multiplicity of closely spaced fine pores defining paths for discharge of said gases and which exhibit an increase in dynamic wet pressure and/or bubble release pressure as a result of deposition of foulants, each of said diffusion elements being in communication with its own individual flow regulating means through its own individual plenum downstream of the flow regulating means, whereby said flow regulating means tend to promote gas flow through said diffusion elements at similar rates.

2. The apparatus according to claim 1 wherein said diffusion elements are divided into two or more groups, and said liquid treatment apparatus includes means for adjusting the flow of gas through said diffusion elements in a portion of said groups to apply said gas at an enhanced flow rate and/or pressure differential in that portion of said groups as compared to another group or groups in the gas distribution network.

3. The apparatus according to claim 2 wherein said liquid treatment apparatus also includes means to restrict the introduction of cleaning gas through the diffusion elements to that portion of said groups having an enhanced flow rate and/or pressure differential.

4. The apparatus according to claim 2 wherein said means for adjusting the flow of gas includes means for adjusting the flow of treating gas before cleaning is initiated.

5. The apparatus according to claims 3 or 4, wherein each of said groups constitutes diffusion elements within an individual tank in a multi-tank plant.

6. The apparatus according to claim 1 wherein said source of cleaning gas comprises a source of HCl and the apparatus includes means for introducing HCl as the cleaning gas into said network.

7. The apparatus according to claims 1, 2, 3 or 4, wherein said means for introducing treating gas and cleaning gas into said network includes means for admixing HCl with said treating gas, and means for controlling the concentration of HCl in the resulting mixture at a level sufficient to clean said diffusion elements.

8. The apparatus according to claims 1, 2, 3 or 4, wherein said means for introducing treating gas and cleaning gas into said network includes means for admixing HCl with said treating gas, and means for controlling the concentration of HCl in the resulting mixture at a mole fraction within the range from about $4x10^{-5}$ to about $3.1x10^{-2}$.

9. The apparatus according to claims 1, 2, 3 or 4, wherein said means for introducing treating gas and cleaning gas into said network includes means for admixing HCl with said treating gas and means for discharging the resulting mixture of gases into the plenums at a rate of about 6 to about 8 SCFM per square foot of active discharge area of said diffusion elements.

10. The apparatus according to claim 9 including means for controlling the concentration of HCl in the mixture of treating gas and HCl at a level sufficient to clean said diffusion elements.

11. The apparatus according to claim 9 including means for controlling the concentration of HCl in the mixture of treating gas and HCl at a mole fraction within the range from about $4x10^{-5}$ to about $3.1x10^{-2}$.

12. Liquid treatment apparatus comprising:

a gas distribution network in a tank;

means for introducing treating gas into said network;

a source of cleaning gas;

means including valve means for intermittently introducing into said network said cleaning gas alone or in admixture with the treating gas;

a plurality of flow regulating means distributed about a submerged portion of the network for receiving the aforementioned gases and for discharging them into a plurality of plenums downstream of the flow regulating means, said flow regulating means tending to promote gas flow into said plenums at similar rates; and

a plurality of at least ten multi-pore area release diffusion elements sealingly engaged and in communication with said plenums for receiving said gases, said diffusion elements being members which comprise a multiplicity of closely spaced fine pores defining paths for discharge of said gases and which exhibit an increase in dynamic wet pressure and/or bubble release pressure as a result of deposition of foulants, each of said diffusion elements being in communication with its own individual flow regulating means through its own individual plenum downstream of the flow regulating means for tending to promote gas flow through said diffusion elements at similar rates;

measuring means for monitoring the operation of said liquid treatment apparatus by measuring changes in operating parameters of the apparatus that indicate dynamic wet pressure changes across the diffusion elements with sufficient precision for initiating the flow of cleaning gas with sufficient frequency for maintaining the dynamic wet pressure across the diffusion elements in a range not to exceed about 25 inches of water gauge above said base condition.

13. The apparatus according to claim 12 wherein said measuring means comprises means for measuring pressure and/or flow of gas through one or more diffusion elements.

14. The apparatus according to claim 12 wherein said measuring means comprises means for measuring said changes with sufficient precision to maintain the dynamic wet pressure across the diffusion elements in a range not to exceed about 15 inches of water gauge above said base condition.

15. The apparatus according to claim 12 wherein said measuring means comprises means for measuring the pressure and flow of gas through at least one individual diffusion element among said plurality of diffusion elements.

16. The apparatus according to claim 12 wherein said measuring means comprises means for measuring the hydrostatic pressure of said liquid at about the elevation of the diffusion elements, means for measuring gas pressure within a plenum downstream of the flow-regulating means, and means for measuring the gas pressure within a header supplying gas to said air flow regulator.

17. The apparatus according to claim 12 wherein said liquid treatment apparatus includes means responsive to a change in dynamic wet pressure across one or more of said diffusion elements for initiating or controlling or terminating the flow of cleaning gas in said network.

18. The apparatus according to claim 12 wherein said measuring means includes means for measuring the dynamic wet pressure across one or more of said diffusion elements.

19. The apparatus according to claim 12 wherein said diffusion elements are divided into two or more groups, said measuring means includes means for measuring flow of gas through said groups of elements, and said liquid treatment apparatus includes means for varying the flow of gas to a portion of said groups of elements in response to said measurement of gas flow.

20. The apparatus according to claim 19 wherein said measuring means includes means for measuring pressure of said gas passing through said groups of elements, and said liquid treatment apparatus includes means for varying the flow of gas to a portion of said groups of elements in response to said measurements of pressure and gas flow.

APPENDIX C

1. Liquid treatment apparatus comprising:

A. a natural or man-made liquid impound having a bottom surface,

B. a network of generally horizontal treating gas supply pipes supported in said impound above said bottom surface,

C. a plurality of diffusers comprising plenums mounted on said pipes at elevated positions relative to said surface and supporting a plurality of area-release diffusion elements above said surface in communication with the network to direct treating gas through the elements into the liquid[,]

D. a cleaning gas source in communication with the plenums to pass cleaning gas through the elements and clean them,

E. a plurality of flow regulating means connected with said cleaning gas source and with said plenums for regulating the flow of cleaning gas or both treating gas and cleaning gas to said plenums, said flow regulating means being sized or adjusted to deliver the gas or gases at a substantially similar rate to each of said elements, and

F. retaining and sealing means, positioned at the peripheries of the respective elements, for effectively securing said elements in gas-tight relationship with their respective plenums and preventing escape of treating and cleaning gas from said plenums, except through said elements.

2. Liquid treatment apparatus comprising:

A. a natural or man-made liquid impound having a bottom surface,

B. a network of generally horizontal treating gas supply pipes supported in said impound,

C. a plurality of diffusers comprising plenums mounted on said pipes at elevated positions relative to said surface and supporting a plurality of area-release diffusion elements above said surface in communication with the network to direct treating gas through the elements into the liquid, said elements having upper and lower surfaces bounded by porous peripheral sides and said diffusers including means for preventing escape of gas through said element sides into said liquid,

D. a cleaning gas source in communication with the plenums to pass cleaning gas through the elements and clean them,

E. a plurality of flow regulating means connected with said cleaning gas source and with said plenums for regulating the flow of said cleaning gas or both treating gas and cleaning gas to said plenums, said flow regulating means being sized or adjusted to deliver the gas or gases at a substantially similar rate to each of said elements, and

F. retaining means for securing said elements in gas-tight relationship with their respective plenums.

3. Liquid treatment apparatus comprising:

A. a natural or man-made liquid impound having a bottom surface,

B. a network of generally horizontal treating gas supply pipes supported in said impound,

C. a plurality of diffusers comprising plenums mounted on said pipes in said impound at elevated positions relative to said surface and supporting a plurality of area-release diffusion elements above said surface in communication with the network to direct treating gas through the elements into the liquid, said elements having upper and lower surfaces bounded by peripheral sides, and said plenums comprising gas-tight enclosures that enclose said lower surfaces and that include upstanding
wall means facing and adjacent to said sides,

D. a cleaning gas source in communication with the plenum to pass cleaning gas through the elements and clean them,

E. a plurality of flow regulating means connected with said plenums for regulating the flow of cleaning gas or broth treating gas and cleaning gas to said plenums, said flow regulating means being sized or adjusted to deliver the gas or gases at a substantially similar rate to each of said elements, and

F. retaining means for securing said elements in gas-tight relationship with their respective plenums.

4. Liquid treatment apparatus comprising:

A. a natural or man-made liquid impound,

B. a network of generally horizontal treating gas supply pipes supported in said impound,

C. a plurality of diffusers comprising plenums mounted on said pipes at elevated positions relative to said surface, said plenums being positioned beneath and in supporting engagement with a plurality of area-release diffusion elements and supporting said elements in communication with the network to direct treating gas under pressure through the plenums and elements into the liquid, said pressure exerting upward force on said elements relative to their respective plenums when the plenums are pressurized,

D. a cleaning gas source in communication with the plenums to pass cleaning gas through the elements and clean them,

E. a plurality of flow regulating means connected with said plenums of regulating the flow of cleaning gas or both treating gas and cleaning gas to said plenums, said flow regulating means being sized or adjusted to deliver the gas or gases at a substantially similar rate to each of said plenums, and

F. peripheral sealing members, positioned upon upward facing surfaces of the elements at the peripheries of the elements and in sealing contact with portions of the respective plenums and elements, and

G. peripheral retaining means for securing said elements to their respective plenums, said retaining means including overlying members which at least partly overly the sealing member, said overlying members restraining upward movement of said sealing members and elements, whereby said upward force on said elements and said restraining action clamp said sealing members between said overlying members and said elements.

5. Apparatus according to claim 3 wherein the peripheries of said elements and said upstanding wall means have horizontal spacings between them, and sealing means having bodies of selected horizontal width are positioned within said horizontal spacings for preventing escape of gas from said plenums except through said elements.

6. Apparatus according to claim 1, 2, 3 or 4 wherein the liquid is wastewater and said impound is equipped for biological treatment of said wastewater, including aeration with said treating gas.

7. Apparatus according to claim 1, 2, 3 or 4 wherein the elements are multipore diffusion elements.

8. Apparatus according to claim 1, 2, 3 or 4 wherein the elements are free of fastener through-holes.

9. Apparatus according to claim 1, 2, 3 or 4 wherein the elements have peripheral zones of lesser permeability than the portions of the elements surrounded thereby.

10. Apparatus according to claim 1, 2, 3 or 4 wherein the elements have peripheral zones of greater density than the portions of the elements surrounded thereby.

11. Apparatus according to claim 1, 2, 3 or 4 wherein the elements have boundary portions with enhanced volumetric compression ratio relative to the portions of the elements surrounded thereby.

12. Apparatus according to claim 1, 2, 3 or 4 wherein at least a major portion of the elements are mounted on their own individual plenums.

13. Apparatus according to claim 1, 2, 3 or 4 wherein at least a major portion of the elements have their own individual flow regulating means.

14. Apparatus according to claim 1, 2, 3 or 4 wherein the flow regulating means include flow regulating orifices of fixed or auto-adjustable size positioned beneath said elements.

15. Apparatus according to claim 1, 2, 3 or 4 wherein at least a major portion of the elements are mounted on their own individual plenums and have their own individual flow regulating means.

16. Apparatus according to claim 1, 2, 3 or 4 wherein the elements are multipore diffusion elements that are free of fastener through-holes, with at least the majority of the elements being mounted on their own individual plenums and having their own individual flow regulating means which include flow regulating orifices of fixed or auto-adjustable size positioned beneath said elements.

17. Apparatus according to claim 2 or 3 wherein the retaining means are located at the element peripheries.

18. Apparatus according to claim 1, 2, 3 or 4 wherein the retaining means extend about the entire peripheries of the elements.

19. Apparatus according to claim 1, 2, 3 or 4 wherein the retaining means secure the elements about their entire peripheries.

20. Apparatus according to claim 1, 2, 3 or 4 wherein there is indirect contact between the elements and the retaining means.

21. Apparatus according to claim 1, 2, 3 or 4 wherein the retaining means are rings positioned at the peripheries of the elements.

22. Apparatus according to claim 21 wherein the rings have upright, cylindrical walls that surround the peripheries of the elements.

23. Apparatus according to claim 21 wherein the rings have horizontally, inwardly extending flanges partly overlying said elements for directly or indirectly placing down-pressure on said elements at their peripheries.

24. Apparatus according to claim 21 wherein the rings have upright, cylindrical walls that surround the peripheries of the elements and horizontally, inwardly extending flanges partly overlying said elements for directly or indirectly placing down-pressure on said elements at their peripheries.

25. Apparatus according to claim 24 wherein the flanges exert down pressure on said elements by tightly clamping O-ring seals against upward facing surfaces of the elements.

26. Apparatus according to claim 21 wherein the rings are secured by internal thread on the rings to matingly compatible threads on the outer surfaces of upstanding wall means of the plenums.

27. Apparatus according to claim 1, 2, 3 or 4 wherein the retaining means are rings located at and extending about the element peripheries, which partly overlie said elements for directly or indirectly placing down-pressure on said elements at their peripheries and for securing the elements to their respective plenums about their entire peripheries.

28. Apparatus according to claim 1, 2, 3 or 4 wherein the respective elements have steps including upstanding sides in the upper portions of their peripheries for receiving and supporting sealing members.

29. Apparatus according to claim 1, 2, 3 or 4 including sealing means comprising peripheral bands of elastomeric material that extend about the sides of the elements.

30. Apparatus according to claim 1, 2, 3 or 4 wherein sealing means of circular shape in plan view are positioned at the peripheries of the elements for preventing escape of gas from said diffusers except through said elements, the elements respectively include upper gas discharge surfaces and upstanding side walls, and the sealing means bear against said side walls.

31. Apparatus according to claim 30 wherein the sealing means are positioned at upper edges of said walls.

32. Apparatus according to claim 30 wherein the sealing means are positioned at intersections of said side walls and said gas discharge surfaces.

33. Apparatus according to claim 30 wherein the sealing means are of lesser height than the elements.

34. Apparatus according to claim 30 wherein the upstanding side walls comprise, at least in part, walls of steps located in the upper portions of the peripheral edges of the elements, and the sealing means nest in said steps.

35. Apparatus according to claim 1, 2, 3 or 4 wherein resilient, O-ring sealing members are positioned adjacent the peripheries of the elements and in sealing contact with portions of the respective plenums and elements.

36. Apparatus according to claim 1, 2, 3 or 4 wherein the elements have upper and lower surfaces bounded by peripheral sides, the plenums comprise gas-tight enclosures that enclose said lower surfaces and that include upstanding wall means facing and adjacent to said sides, the peripheries of said elements and said upstanding wall means have horizontal spacings between them, sealing means having bodies of selected horizontal width are positioned within said horizontal spacings, and the sealing means body widths are larger than said spacings, whereby said bodies are held under horizontal compression between the peripheral sides of the elements and the upstanding wall means for preventing escape of gas from said plenums except through said elements.

37. Apparatus according to claim 1, 2, 3 or 4 wherein a sealing means of circular shape in plan view is positioned at the periphery of the element for preventing escape of gas from said plenum except through said element, and the plenum, element and retaining means collectively contact the top, bottom, inside and outside surfaces of the sealing means.

38. Apparatus according to claim 1, 2, 3 or 4 wherein the elements have vertical sides that are enclosed by the plenums, by resilient sealing means and by said retaining means in gas-tight relationship with said plenums.